Framing and the Annuitization Decision

Bockweg, Christian; Ponds, Eduard; Steenbeek, O.W.; Vonken, Joyce

Publication date:
2016

Document Version
Publisher's PDF, also known as Version of record

Network for Studies on Pensions, Aging and Retirement

NETSPAR ACADEMIC SERIES

Framing and the annuitization decision

Experimental evidence from a Dutch pension fund

Christian Bockweg, Eduard Ponds, Onno Steenbeek and Joyce Vonken

DP 03/2016-007

Framing and the Annuitization Decision[1]

Experimental Evidence from a Dutch Pension Fund

Christian Bockweg
Lucht Probst Associates GmbH
Germany

Eduard Ponds[2]
Tilburg University, APG Asset Management, Netspar
The Netherlands

Onno Steenbeek
Erasmus School of Economics, APG Asset Management
The Netherlands

Joyce Vonken
APG
The Netherlands

March 2, 2016

Abstract
We report the effects of framing and default settings in annuity demand after conducting a survey-based experiment with over 3,000 members of a Dutch occupational pension plan. The participants were asked to allocate their real projected pension accrual between a life annuity and a partial lump sum. In particular, we investigated the joint effects of consumption and investment frames and gain and loss frames. We present strong evidence for framing and default setting effects in annuity demand. We also find robust evidence of individual characteristics of influence annuity demand, highlighting the importance of heterogeneity among participants. Framing and default effects remain significant when we control for individual characteristics. We conclude Dutch plan members generally welcome the partial lump sum option over full annuitization. Framing and default settings are generally capable of predictively steering annuity demand. The precise effect framing may have also depends on the institutional environment, which predefines the perspective through which individuals filter annuities.

Keywords: Annuity puzzle, framing, pension annuities, lump sum
JEL codes: G02, G11, H55

---

[1] The authors are thankful for helpful comments from Ruben Cox, Alexandra van Geen, Rob van den Goorbergh, Thomas Post, and participants of the International Pension Workshop of Netspar at Leiden, 27-29 January 2016.
[2] Corresponding author: eduard.ponds@apg.nl

1 Introduction

The low take-up of annuities by US retirees, better known as the annuity puzzle, has been intensively researched. Several explanations have been put forward, among them (Brown 2007) "rational explanations" rooted in economic theory and "behavioral explanations" based on human biases in valuing annuities. The Dutch pension fund system, where the current payout is exclusively in annuities, is considering the introduction of a pension payout in the form of partial lump sums. This likely change is stimulated by the recent change in UK legislation that allows for the withdrawal of pension capital in the form of full or partial lump sums as an alternative to full annuitization.[3] These (probable) reforms create unique opportunities to test important hypotheses about the US annuity puzzle in both the Netherlands as well as the United Kingdom.

Standard economic theory suggests that a utility-maximizing individual with an uncertain lifetime would prefer to convert his or her entire wealth into an actuarially fair annuity (Yaari, 1965). This suggestion, however, differs greatly from empirical research observations, leaving economists puzzled about actual agents' behavior. With standard theory failing to satisfactorily explain this annuity puzzle, more promising explanations come from behavioral economists, who stress that decisions in the pension domain are subject to a number of behavioral biases. Using prospect theory (Kahneman and Tversky, 1979) and mental accounting (Thaler, 1985), annuities are shown to be systematically undervalued by retirees (Hu and Scott, 2007). Individuals of lower cognitive ability especially tend to make mistakes in valuing annuities (Brown et al., 2014). One line of research focuses on the use of so-called investment framing instead of consumption framing (Brown et al., 2008). The key to the undervaluation of annuities is that retirees in the United States are stuck in an investment frame, in which the annuity is perceived as a risky gamble depending on their uncertain remaining lifetime rather than a collective longevity insurance scheme. Consumption framing would stress the latter with its focuses on a steady stream of income as long as one lives.

Until now, the framing hypothesis has only been tested for the United States (Agnew et al., 2008; Beshears et al., 2014; Brown et al., 2008, 2013). These experiments are characterized by two major drawbacks. First, the choices presented are relatively unrelated to the respondents' real-life situation and, second, the specific institutional environment has probably educated and framed the US respondents in a specific way, stressing pension capital rather than pension annuities. Testing the framing hypothesis outside the United States allows us to evaluate its general validity. Since Dutch plan members are used to annuities, they are likely to evaluate them through a consumption frame and to be less sensitive to the investment frame. Researching the annuity puzzle and the framing hypothesis in the Netherlands therefore adds to the empirical evidence on both phenomena. In this paper, we present the first results of testing this annuity puzzle and the framing hypothesis in the institutional environment of the Netherlands, where people are used to full annuitization.

[3] See Loibl et al. (2015) for an early evaluation of the new regulation in the United Kingdom on the use of accrued pension capital.

The choices are based on the respondents' real pension accrual and on their own pension plans, to make the choices as realistic as possible. Unlike Brown et al. (2013), we find strong evidence of joint effects of combining investment and consumption frames with gain and loss frames.

The remainder of this paper is organized as follows. Section 2 gives an overview of the literature. Section 3 provides a brief introduction to the Dutch pension system and its implications for research into annuitization behavior. Section 4 describes the methodological approach, as well as the datasets. Section 5 presents and evaluates the empirical results. Section 6 discusses findings in relation to the annuity puzzle and the role of professionals in offering pension choice options. Finally, Section 7 concludes the paper.

2 Literature review

In a series of publications, Kahneman and Tversky challenged the theory of rational consumer choice when demonstrating that the stability of preferences is strongly affected by the frames through which prospects and outcomes are evaluated (Kahneman and Tversky, 1984; Tversky and Kahneman, 1981, 1986). Describing a decision problem in terms of gains or losses and suggesting certainty in a situation of uncertainty (pseudo-certainty effect) for example are shown to reverse preferences.

These concepts have been recently applied to explain the annuity puzzle. Since annuities are both collective longevity risk insurance as well as a financial product, highlighting either aspect will change how people perceive an offered contract. Annuities appear more attractive when framed as the former (Gentry and Rothschild, 2006). Another kind of framing occurs when people receive their pension statement in terms of retirement income streams, as opposed to total lump sum values. Benartzi et al. (2011) find that plan members receiving their pension statement in terms of retirement income streams are more likely to annuitize, other things being equal.

2.1 Framing

Brown et al. (2008) argue that mental accounting applies and annuities are evaluated as either just one possible investment among many (investment frame) or as only a smooth retirement consumption path (consumption frame). In an investment frame, annuities appear to be relatively unattractive, because their total payoff depends on an unknown lifetime length. Income from a riskless bond, in turn, will be independent from that stochastic variable. Additionally, the owner of the annuity runs the risk of losing the entire principle, while a bond could be passed on as a bequest. Since people are loss averse, this aspect makes the annuity become even more unattractive. Furthermore, annuities appear as poor investments because of fiercer liquidity constraints.

On the other hand, individuals filtering annuities through a consumption frame appreciate the protection against outliving their resources and not having to cut down on consumption when living longer than expected. Loss aversion will further strengthen their preference for annuities, since the loss of longevity protection looms stronger than possible gains from holding another asset (e.g., a riskless bond).

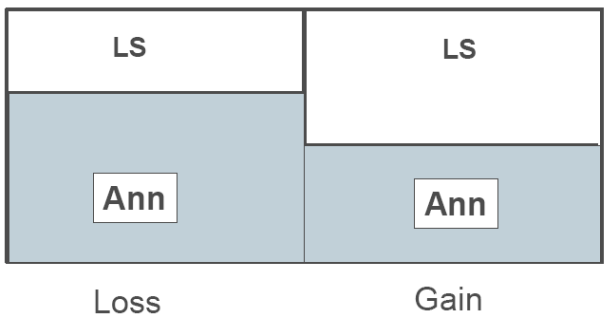
To put respondents in a consumption or investment frame in experiments, Brown et al. (2008) alter the vocabulary used in explaining a specific decision problem. For the investment frame, the decision problem is explained in investment-related language, using words such as invest, risk, return, and payoff. For the consumption frame, the language avoids anything related to financial products and instead talks about purchasing power, consumption payments, income, and so forth.

Brown et al. (2013) combine the consumption versus investment frames presented to respondents with effects from gains and losses. They thus create four different frames, which are also part of our research: investment gain (IG), investment loss (IL), consumption gain (CG), and consumption loss (CL). Two behavioral effects are at play in the four combined frames: loss aversion and the pseudo-certainty effect. These two behavioral effects interact with each other and form the reflection effect (Fagley, 1993).

1) Loss aversion

Prospect theory suggests that, departing from a reference point, losses have much stronger effects than gains do and hence more potential to influence decisions (Kahneman and Tversky, 1979). Since losses loom heavier than gains, annuities are more appealing in a loss frame than in a gain frame. The figure 1a below illustrates the annuity position in the gain and loss examples.

Fig. 1a: Loss aversion and the impact of gain and loss frames on annuity demand



2) Pseudo-certainty effect

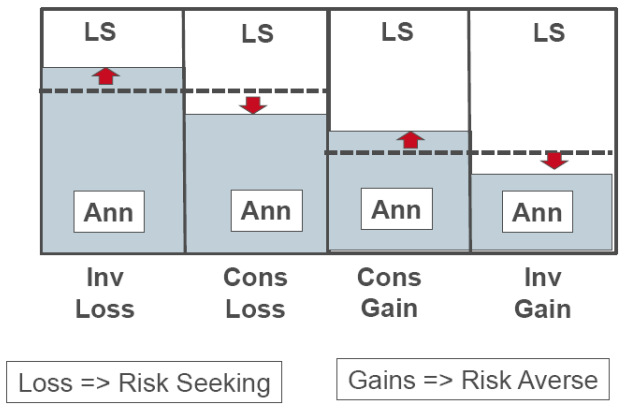
The key difference between the consumption and investment frames is how agents perceive the risks associated with annuities. In a consumption frame, annuities are appealing because they are perceived as a certain payout (longevity insurance). In an investment frame, they are unattractive, because they are perceived as an uncertain payout, since the return depends on the remaining lifetime. Since the underlying risk is identical and only the *perceived* riskiness (certainty) is different, this can be seen as a practical application of the pseudo-certainty effect as implied by prospect theory. The consumption frame views annuities as a certainty, whereas the investment frame sees annuities as an uncertainty.

3) Reflection effect

According to the so-called reflection effect (Fagley, 1993), describing a decision problem in terms of gains or losses as well as suggesting certainty or uncertainty (pseudo-certainty

effect) can reverse preferences. People show risk aversion for positive gambles and risk-seeking behavior for negative gambles. Hence, they will prefer certain gains over uncertain gains but uncertain losses over certain losses. To put it differently, they gamble to avoid losses but they avoid gambling to capture possible gains. Individuals are likely to show a strong preference for annuities when additional annuitization is explained in consumption language (certain gain). When investment language is used, additional annuitization is perceived as an uncertain gain. Individuals then will be more inclined to enlarge their lump sum position (certain gain). On the other hand, explaining the effects of lower annuitization in investment language is experienced as an uncertain loss and agents will be inclined to gamble by holding or more probably by enlarging their annuity position (uncertain loss). Less annuitization explained in consumption language is perceived as a certain loss. Individuals prefer to take a gamble by moving to the risky position of more lump sum (uncertain loss).
The figure 1b illustrates the changes in the initial annuity positions in the loss resp. gain frames (dotted lines) by the interaction of gain and loss examples with investment and consumption language respectively.

Fig. 1b: Reflection effect: interaction of loss/gain frames and investment/consumption frames and the impact on annuity demand



2.2 Defaults

Apart from framing, professionals may also steer individual decision-making in pensions with help of defaults. Since the introduction of the Save More Tomorrow program (Thaler and Benartzi, 2004) in many pension plans in the United States, defaults have become a tool for pension professionals and policy makers. If, at some point, partial lump sum payments are allowed in the Netherlands, pension professionals will have to decide on default settings for those unwilling or unable to make an active choice. This research does not take a position regarding the optimal default for a specific group of plan members, but it does aim to describe how plan members react to defaults. In doing so, the efficiency of defaults and responsiveness are addressed.
The predictable effects of default settings on the lump sum take up are very helpful to place the size of the effects of framing in perspective.

3 The Dutch pension system and its relation to framing

The pension system in the Netherlands is based on three pillars: a first pillar, the public pay-as–you-go pension (AOW pension); an obligatory occupational second pillar funded system; and a complementary voluntary third pillar to provide for additional tax-sheltered retirement savings (Pensioen Federatie, 2015).

The **first pillar** pension offers a flat-rate benefit to all residents at retirement age, regardless of previous income or employment. The gross benefit level is around US$1,700 per month for married couples and $1,200 for singles (2015).[4] The first pillar pension represents a considerable amount of retirement income at the lower end of the income distribution. It must be assumed that whatever annuitization behavior is observed, it will be partly driven by the relative importance of the first pillar.

Participation in a fully funded **second pillar** pension scheme is mandatory for most employees. These pension plans are mainly run by pension funds and are independent from the plan sponsor. Pension funds in the Netherlands can be industry-wide funds, corporate funds, or funds for independent professionals. In the past, nearly all schemes were traditional defined benefit (DB) plans with fully indexed pension rights based on final salaries. Even though there is a shift toward average-pay DB plans with conditional indexation, most employees are covered by a collective plan in which accruals, contribution levels, indexation, and investment strategies are uniform among plan participants (Kemna et al., 2011).

The **third pillar** comprises tax-facilitated individual pension products. It is mainly used by the self-employed and employees for whom no collective scheme is available or who want to build up additional pension rights.

The pension law requires all pension payouts in the second pillar to be annuitized[5]. Various studies suggest that the welfare of citizens in the Netherlands might be improved by reducing the level of mandatory annuitization in order to address liquidity needs, precautionary motives, and bequests (Brown and Nijman, 2012, Bart et al. 2016). Pension funds increasingly allow plan members to choose variation of the annuity level. Lump sum payouts are not allowed, but introduction of this option is currently under debate. This study should help to determine the extent to which Dutch plan members will use the possible introduction of partial lump sum payouts and how professionals could influence and help individual decision making with regard to these new choice options.

Dutch plan members receive annual statements on their projected accrual upon retirement. These statements do not indicate the total value of accrued wealth but provide an expected yearly gross pension income if the plan member continues his or her career at current salary levels until reaching retirement age. This has important implications for the framing hypothesis. Mottola and Utkus (2007) find significantly higher annuitization rates, when pension accrual is stated in terms of annuities rather than lump sums. Benartzi et al. (2011) find the same pattern and argue that this is because communicating accrual in annuities

[4] Exchange rate €1 = $1.10 (December 2015).

[5] The Netherlands is the only country in the world with mandatory full annuitization of second pillar retirement savings, cf. Garciá-Huitrón and Ponds (2015).

promotes consumption framing, while reporting accrual in lump sums fosters investment framing.

4 Methodology and data

We analyze data from a survey-based experiment with a hypothetical annuitization decision. The stated annuitization and lump sum preferences are matched with an array of behavioral and rational variables, motivated through earlier findings and models. Observations are taken from a survey among participants of a large pension fund. The survey is personalized using proprietary pension plan data.

4.1 Two-step approach

The analysis of lump sum take-up proceeds in two stages:

1. We first present the choice options as neutrally as possible. The evidence from this neutral setting allows us to draw a picture of the typical full annuitizer as well as the typical lump sum taker. This is an important step in our research, since this baseline level of lump sum take-up will serve as the benchmark when assessing framing effects.
2. Second, we assess the impact of framing and default settings. Keeping other things equal, we alter the language and explanatory examples in the experiment in accordance with the four frames explained above: CG, CL, IG, and IL. Additionally, to place the effect of framing in perspective, two extra frames with different defaults are applied, one with the default set at a 0% lump sum plus a flat annuity (dflat) and the other with a 10% lump sum payment plus a high-low construction (dhigh) as the default Compare the next section for an explanation of the high-low construction. Assessment of the framing and default effects proceeds in three sub-steps:
   2.1. The level of lump sum take-up across the different frames and defaults is analyzed, giving a first indication of the direction in which the frames and defaults work.
   2.2. Regression analyses ensure the statistical significance of the results of item 2.1 and test the robustness of the framing effect to the inclusion of other variables. Control variables are introduced to the analysis.
   2.3. Finally, interaction terms between the frames and the other variables are added to the regressions from item 2.2 to determine the characteristics associated with higher or lower sensitivity to framing.

4.2 The experiment

The experiment is a personalized two-step allocation procedure. In step 1, respondents allocate their projected pension income to a lifetime annuity and a (partial) lump sum payment of up to 20% of the projected accrued pension capital. In step 2, respondents can decide to receive pension benefits as a flat annuity or opt for actuarially fair variations in the payout profile. They can choose either a high–low profile, where the pension payment is higher in the first years and thereafter lower than the level annuity payment, or a low–high construction, where the annuity payments are first lower and then higher than the level payment. Respondents were allowed to switch back and forth between the two steps to ensure they chose what they considered an optimal allocation. The second step was included in the game because both high–low and low–high constructions are available options in the

Dutch system. In essence, the high–low variation can be considered a limited form of lump sum payment. By looking at the two steps, it becomes apparent to which extent respondents are consistent in their preference for early/late cash. To avoid further complications, a number of real-life options were fixed in the experiment: the retirement age was fixed at the age set in the first pillar (67 years), partner pension reallocation was omitted, and the high–low switching point was set to age 70. Further, the conversion between annuity payments and lump sum payments as well as among high–low payments is based on uniform actuarially fair discount and exchange factors as used by the pension fund, including gender and birth cohort-specific mortality tables.

4.2.1 Methodological remarks on annuity experiments: Advances and pitfalls

Two major issues concerning experiment-based annuity preferences must be pointed out. First, respondents' decisions have no consequences in real life. Obviously, the stakes would feel much higher if this were a real-life decision. Hence, some bias may occur, since people may not put as much thought into their decision as they would otherwise. Second, the respondents may not be able to relate in a meaningful manner to the decision problem presented, its dimensions, and the hypothetical stakes. In fact, many annuitization experiments suffer from alienation bias (Hanemann, 1994; Whittington, 2002), stemming from the applied "one size fits all" decision problems.[6] The setup of our study limits alienation bias, since it uses the individual respondent's actual personal data provided by the pension fund on the accrued pension income upon retirement. The respondents should recognize the presented information from their annual pension statements, which creates a realistic scenario of choice options to which the respondent can actually relate. This is a major advantage over the uniform amount decision problems often applied in the experimental literature.

4.2.2 Setting up the two-step decision problem

As explained before, the decision problem is set up in two steps, each presented on a separate page in the online survey.

In **step 1**, respondents are introduced to the allocation game. They are asked to imagine they retire at age 67, by which time they will have accrued €X in annual gross pension rights. They are told that they can decide on their preferred payout scheme in two subsequent steps. After a brief introduction to the two steps, it is explicitly stated that the first choice will influence the options in the second step and that one can switch back and forth as often as preferred. Additionally, the respondents are informed that the pension fund aims to adjust for inflation. Then, an example explains how a decrease/increase in the lump sum take-up affects one's annuity payments. In the introduction and in the explanatory example, different respondents are confronted with different wording according to the four frames or with neutral wording with a pre-selected choice (the two default settings).

[6] Examples of this type of analysis are: Cappelletti et al. (2013), who asked Italian respondents whether they prefer a monthly annuity of €1,000 to a variety of lump sum payments; Agnew et al. (2008), who ran a multi-period pension income allocation/investment game in which respondents allocated an initial endowment of €60; Beshears et al. (2014), who provided a lump sum equivalent value of $330,000, which was then allocated across different options; and Brown et al. (2008), who tested for the framing hypothesis in an online survey experiment with different choice options each worth $100,000.

On the same page, respondents are asked to take the first step and select one of five lump sum cash outs (0%, 5%, 10%, 15%, and 20% of total pension rights). For every option, the remaining annual pension rights are displayed as well. For an individual with €24,000 of projected annual pension rights, the choice options in step 1 appear below the explanatory text, as in Table 1 .

Table 1 Choice Options in Step 1

option	Lump sum	annual payment
1	0	24,000
2	17,100	22,800
3	34,200	21,600
4	51,200	20,400
5	68,300	19,200

In **step 2** (on the next page of the survey) respondents receive further explanations on the high–low decision and an explanatory example that again differs in wording according to the frames. Below, they are shown 11 choice options: one flat annuity, which is exactly the remaining annual pension rights from step 1, and five high–low as well as five low–high schemes covering, respectively, both the upper and lower most extreme allocations currently allowed for by the pension fund.

The ratio between the highest and lowest payment cannot be higher than 100:75, including the first pillar pension. Respondents can either select an option and proceed to the following questions or they can go back to step 1 if they are not happy with the options presented in step 2. Given that the individual chooses the second option in step 1, the options presented in step 2 will be as in Table 3.

Table 2 Choice Options in Step 2

option	Benefit during first 3 years	Benefit from year 4 onward
1	20,500	25,700
2	21,100	25,400
3	21,800	25,000
4	22,500	24,700
5	23,200	24,400
6	24,000	24,000
7	24,800	23,600
8	25,700	23,200
9	26,700	22,700
10	27,700	22,200
11	28,900	21,700

4.2.3 Frame implementation

In total, we define seven different frames: neutral (baseline), CG, CL, IG, IL, flat default, and partial lump sum default. All frames are designed to contain the same amount of information and the same explanatory examples. They only differ in either the wording or the preselected default. For details on the wording, see the exact Dutch survey questions in Appendix C. It is important to note that all respondents were randomly assigned to only one of the seven frames (around 470 participants each) to ensure high-quality data with no interference from learning and spillover effects.

The neutral frame uses neither explicit consumption-related language nor explicit investment-related language and only states the facts. The explanatory example can be interpreted either way, giving an example in terms of gains as well as in terms of losses, to ensure neutrality. It provides a hypothetical baseline level of annuitization for the Dutch case once partial lump sum payments are allowed. It also serves as the benchmark lump sum pick-up for the other frames.

The flat default is exactly the same as the neutral frame in terms of language and examples but adds one sentence explaining that, if the respondent prefers not to make an active choice himself or herself, the fund has preselected 100% annuitization (i.e., zero lump sum) and a flat annuity (i.e., no high–low variation). The corresponding choice options were preselected (pre-activated) in the online survey and could be altered by the respondent.

The 10% and high–low default is a variation of the flat default. The only difference is that now a 10% lump sum payout and the second high–low allocation (where the pension during the first three years of retirement is 10% larger than for the remaining lifetime) is preselected.

The CG frame differs from the neutral frame in terms of language and examples. The wording explains the tradeoff between lump sum payments and annuities in terms of spending and income and "money to pay the bills." This frame is expected to highlight the longevity insurance component of the annuity. The examples explain how purchasing power can be increased and additional protection against having too little to spend during retirement can be gained by selecting a smaller lump sum. For the second step, this is accomplished by selecting a lower pension during the first three years of retirement.

The CL frame uses the same language and terms as the CG frame but, instead, explains how one loses purchasing power and spending money when selecting a higher lump sum.

The IG frame uses investment-related language, such as *return on pension investments*. The annuity is thereby expected to be perceived as a financial product with uncertain returns. The examples then explain how one can increase yearly returns by choosing a smaller lump sum.

The IL frame is again identical in wording to the IG frame but uses examples explaining how yearly returns will decrease once a higher lump sum (higher early pension) is chosen.

4.3 Sample group and data

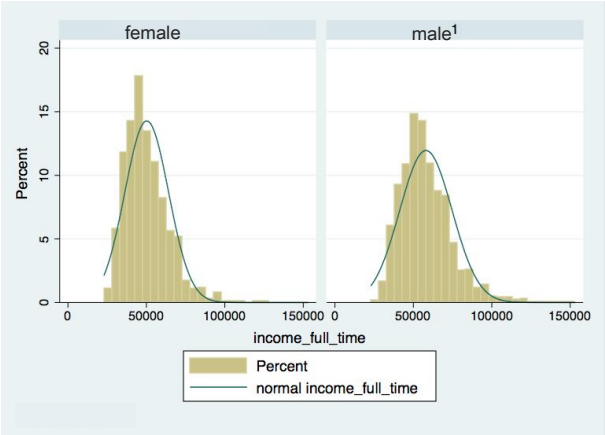
The dataset in this research is derived from a survey run at a large Dutch pension fund. The survey conducted among its plan members had two purposes: First, collect a vast set of relevant variables for the annuitization decision that was not available in the client database and, second, run an experiment with a hypothetical lump sum versus annuity choice to test plan members' reactions to partial lump sum payments, as well as framing and default effects in that context.

4.3.1 Dataset

The online survey was sent to 15,000 individuals who were randomly selected from a panel of active plan members available for client research projects. In total, 3,161 plan members answered all the questions.[7] The average age of the respondents was 55.2 years (median 57.8 years, minimum 23.4 years, and maximum 65.2 years), 72.6% were male, and 71.2% were married. The men earned an average yearly gross full-time income of €58,475 and the women €50,220, compare Figure 2. Figure 3 projects the gross pension income from the pension fund, assuming individuals keep on working till retirement with the same occupational position (either part-time or fulltime). The projected gross pension income is, on average, €27,578 for men and €17,834 for women. In the entire fund, 51% were women, 57% were married plan members, and 14% is divorced. The biggest age group is that between 55 and 65 years, with 57% 45 years or older and 29% 55 years or older.

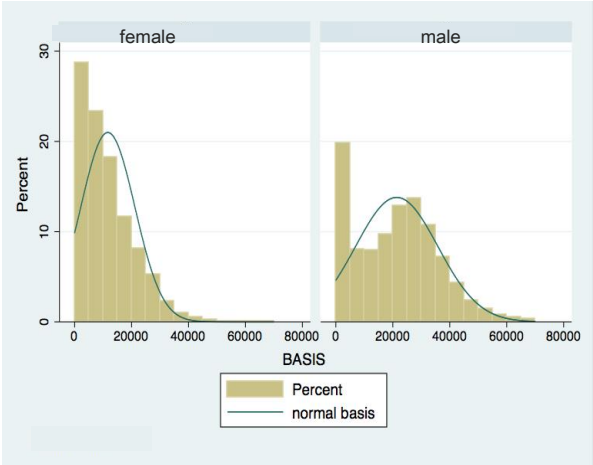
The sample is expected to contain a number of biases. First, male respondents are overrepresented. Since male plan members earn, on average, higher incomes, the average income among survey respondents will be higher. Additionally, there will be a bias toward individuals showing more interest in pension-related issues, since participation was voluntary. Since we use a number of control variables to address the expected biases in sample demographics, these biases should have no significant impact on the empirical results.

Fig. 2. Income by Gender



[7] To ensure quality data, those who decided on the first choice in under 2.5 minutes were dropped from the dataset. We considered it impossible to answer the preceding questions and absorb all the information within that short a time frame.

Fig. 3: Distribution of the projected pension income by gender



4.3.2 Derived variables

From the survey, we distinguish four types of variables: dependent variables, framing variables (independent), behavioral explanatory variables (independent/control), and rational explanatory variables (independent/control). Below, only selected variables are discussed in detail. The full list of variables is provided in Appendix B.

The following **dependent** variables capture the choices made in the two steps of the experiment, hence the stated annuitization/lump sum preferences:

- *lump sum take-up* (which can take the value of one to five for a lump sum take-up of, respectively, 0%, 5%, 10%, 15%, and 20% of total projected pension rights)
- *lump sum* (dummy variable equals one if one of the four partial lump sum options is selected)

The **framing** variables are dummy variables indicating the frame in which the experiment was presented. They are used to assess the framing hypothesis in statistical testing. The following six dummies were constructed: CG, CL, IG, IL, dflat (default set to a zero lump sum and no high–low) and dhigh (default set to a 10% lump sum and high–low).

The **rational economic** variables are used as control variables to assess the robustness of the framing hypothesis. These variables have explanatory power when defining the driving characteristics of annuities and lump sum take-ups. Appendix B presents a complete list of the variables. Below, only the more complex variables and those constructed from multiple survey questions are explained in detail:

- The variables *high–low* and *low–high* are two dummy variables indicating the choice made in step 2 of the experiment. The variable *high–low* equal to one indicates that a higher pension will be paid during the first three years of retirement than during subsequent years and *low–high* equal to one indicates that a lower pension will be paid during the first three years than during subsequent years. Note that, even though these are not standard variables in life-cycle models, they are expected to be an important factor in the Dutch context. Since the high–low construction is, in essence, a

less extreme form of a lump sum payment, a rational individual will recognize the trade-off between the two components in the overall allocation decision.

- The *risk aversion* variable is measured following the survey-based approach of Barsky et al. (1995), in which people are subsequently offered riskier but possibly better-paying job opportunities. According to their answers to these income gamble questions, respondents have been divided into four groups.
- The variable *discount* measures the subjective time value of the respondents' money. Patience in waiting for a lottery payout is employed as a proxy. The respondents are told to imagine they won a lottery that pays out in one year. Then they are asked how much of the prize they are willing to give up to receive the money immediately. The questions are the same as for Cappelletti et al. (2013) and sort the respondents into five groups of intertemporal discounters.

The **behavioral variables** are designed to detect individuals showing difficulties in properly valuing annuities and are derived from the behavioral literature. Our research focuses on the framing effect as a behavioral bias. The additional behavioral variables we employ are control variables that help to assess the robustness of the framing effect and the relevance of purely rational explanations. The variables include involvement, trust, financial and pension literacy, decision confidence, education, cognitive overload from the decision problem, and regular debt on cash accounts. Appendix B contains the full list of variables with brief explanations. Below, only those variables constructed from multiple survey questions are explained in detail:

- The variable *involvement* ranges from zero to one and is constructed from five statements to which respondents indicated their degree of agreement on a five-point Likert scale. The questions are taken from previous internal research projects. The average score is 0.84. Cronbach's alpha[8] to test for the reliability of the constructed variable yields a high outcome 0.73, indicating the respondents are highly involved.
- The variable *trust* ranges from zero to one. It is derived from one question and agreement with three statements on systemic and pension fund-specific trusts, indicated on a five-point Likert scale. The average is 0.57 and Cronbach's alpha is 0.81.
- The variable *cognitive overload* ranges from zero to one and is constructed from agreement (on a five-point Likert scale) to four statements as brought forward by Agnew and Szykman (2010). The average equals 0.47 and Cronbach's alpha is 0.84.
- The variable *Pension Literacy* captures system-specific literacy through eight knowledge questions as previously used within the fund. They are combined into a score ranging from zero to one. The average is 0.78.
- The variable *Financial Literacy* is an application of the measure and questions developed by Lusardi and Mitchel (2007). It is scaled from zero to five, with an average of 4.2[9].

[8] Cronbach's alpha is a measure for the " internal consistency or average correlation of items in a survey instrument to gauge its reliability" (Santos, 1999). The measure ranges from zero to one.

[9] The relatively high averages for the variables Pension and Financial Literacies may be showing two things: Either the original questions are not suited to the underlying population (too easy) or the fund's panel population is indeed very

5 Empirical results

We first assess the lump sum take-up for the Dutch environment under a neutral frame (5.1). Then we evaluate how the partial lump sum decision is steerable for defaults and the framings and check the robustness of the results (5.2). Subsequently we conduct an analysis of interaction effects to assess differences in responsiveness to framing in a heterogeneous sample of plan members (5.3).

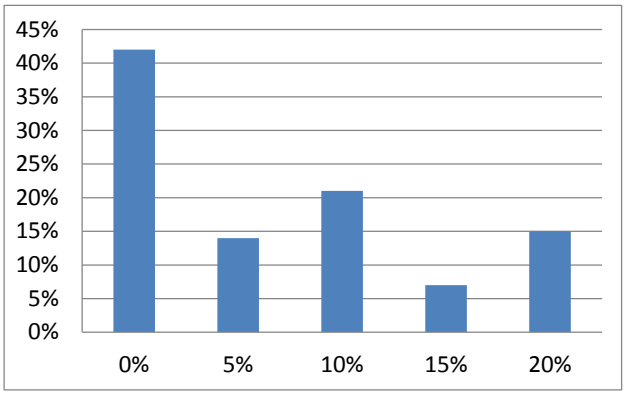
5.1 Hypothetical lump sum take-up in a neutral frame

This section only analyzes the acceptance by Dutch participants of the new optionality of partial lump sum payments within the neutral frame, consisting of 474 respondents.

A majority of 58% of the 474 respondents in the neutral frame indicates to chose for the new optionality of a partial lump sum with an average lump sum pick-up of 12.3% (given a 20% lump sum maximum); 42% stayed with the full annuity position. Over all neutral frame respondents, the average lump sum take-up is 7.1%.

These annuitization rates are higher than the ones reported in the literature on the annuity puzzle in the United States. These higher rates can be explained by the fact that Dutch plan members are used to having their DB pensions annuitized. In the United States, Benartzi et al. (2011) and Hurd and Panis (2006) report that US citizens in DB pension plans also choose a relatively high annuity take-up when offered a lump sum option. Furthermore, we refer to the study of Bütler and Teppa (2007), who find no annuity puzzle for Switzerland, with an average annuitization rate of 84.5%.

Fig. 4. Chosen Lump Sum Options in neutral frame[10]



literate and therefore shows little variation. Defining what actually is the case, however, is beyond the scope of this research.

[10] A follow-up experiment using the same question set for step 1 in the neutral setting but a different sample group finds almost the same pattern as displayed in figure 4 (Alilovic, 2016). The findings of the first and the follow-op experiments are for the lump sum option 0: 42% and 40% respectively, for option 0.05: 14% and 14%, for option 0.10: 21% and 22%, for option 0.15: 7% and 4%, and finally for option 0.20 16% and 20%.

5.2 Steering the partial lump sum decision

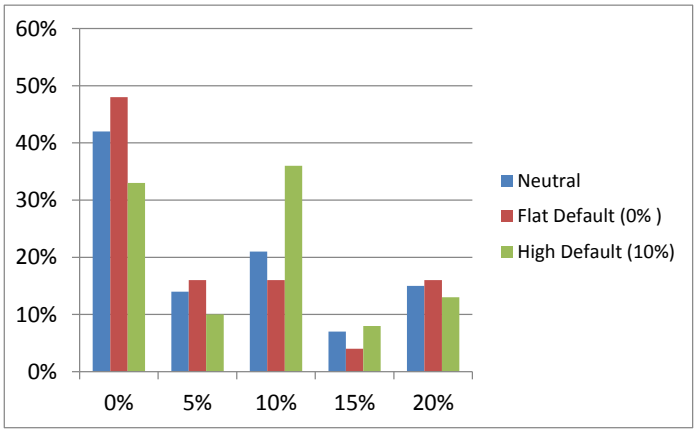
This section evaluates how the partial lump sum decision is steerable through default setting and framing. The analysis proceeds in three stages: First, the differences in lump sum take-up across the different frames are described and motivated according to the predictions in Section 2. We first discuss the responsiveness to default settings (5.2.1), then to framing (5.2.2). Second, standard economic as well as behavioral control variables are included in the analysis to check the robustness of the results (5.2.3).

5.2.1 Impact of defaults

The analysis of defaults is based on a reduced dataset of 1420 observations covering only those respondents who were assigned to either the neutral frame (474) or one of the two default frames (474 and 467).

Figure 4 presents the extent to which respondents choose the default. Not only do more respondents (compared to the neutral frame) choose the preselected choice, but they also move closer overall to the default. The average lump sum payout is 7.1% for the neutral frame, 6.1% for the flat default, and 7.7% for the 10% default.

Fig. 4. Lump Sum Choice per Default



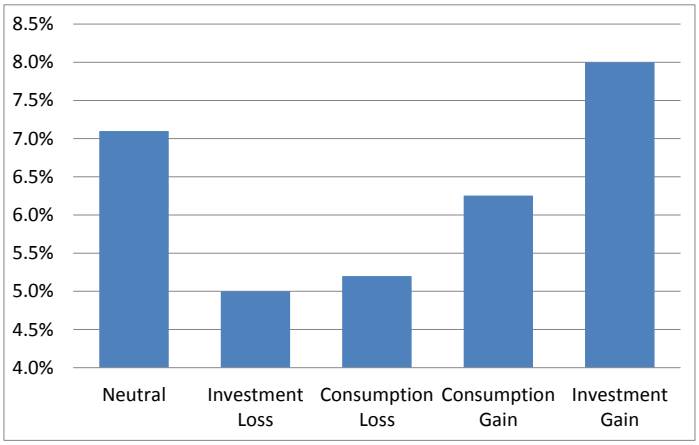
5.2.2 Impact of framing

Now we look at the impact of applying the frames. Figure 5 shows how individual choice differs (on average) across the frames for the partial lump sum decision (step 1 in the experiment). The effect holds for the share of those picking any partial lump sum option as well as for average annuitization rates (i.e., lump sum cash-out rates). The lowest average take-up is for the IL frame, that is 5.2%, and the highest is for the IG frame, at a little over 8%. This spread is much in line with the spread observed for the flat and high default frames, ranging from 6.1% to 7.7%.

Furthermore, we make the important observation from Fig. 5 that the differences between the frames are exactly in line with the predictions implied by the framing hypothesis. In section 2 we explained how preferences are expected to change across the different frames. These mechanisms indeed can be observed in the data. Explaining the choice option with a loss example (less annuities) will lead to a lower preferred lump sum take-up compared to

the take-up in the gain example (more annuities). Compared to the neutral frame, consumption framing evokes higher preference for annuities whereas investment framing stimulates a higher lump sum take-up. Combining the investment and consumption frames with the loss and gain examples lead to interaction effects. Gains are welcomed generally, activating risk-averse attitude. Comparing the two frames with a gain positon, we observe risk-averse behavior in the IG-frame leads to additional lump sum take-up whereas in the CG-framed individuals are induced to increase their annuity position. Losses activate risk-seeking behavior, implying an increase of the lump sum take-up in the CL-frame, but a lower preferred lump sum in the IL-frame.

Fig. 5. Average Lump Sum Pick-Up by Frames (Step 1)



So, the overall impression is quite similar to what has been observed in the application of defaults: framing does matter in the annuity decisions of individuals and does so predictably, in line with insights from behavioral economics.

5.2.3 Robustness of the default and framing effects

This section checks for the robustness of the above results using multiple regression analysis. We assess both the statistical significance of default and framing effects as well as its robustness to the inclusion of other explanatory variables and their relative importance vis-à-vis the frames. We apply different specifications of regression analysis. In each regression, a choice variable is explained by framing variables (dummies for each default and frame), as well as rational and behavioral control variables:

$$decumulation\ choice_i = frame_i\beta_{frame} + econ_i\beta_{econ} + behave_i\beta_{behave} + u_i$$

with i indexing observations, and where, for each i, *frame* is a 1 × k vector of all frame dummies and f_{frame} is the k × 1 vector of all frame parameters. The same vectors are defined for all standard economic variables (*econ)* as well as behavioral variables (*behave*) and u denotes the residuals (error term). Variables whose scales do not allow for a meaningful economic interpretation are standardized such that their means are zero, with a standard deviation of one. Because of the many variables available in the dataset, a vast variety of

model specifications are possible. We did start the analysis with a very broad specification, which was then diminished to what can be considered the best model. Not all of the specifications tested throughout this process of manual data mining are reported. We report a minimal specification with only the framing variables, one specification controlling for (rational) economic factors, another controlling only for behavioral variables, and a combined specification putting together the most relevant variables. We use logit and ordered probit model specifications for the regressions.

Default effects

The impression that lump sum take ups can be steered through default settings is supported by the regression results in Table A.1 in Appendix A[11]. The impact of the flat default is an especially robust result. Individuals experiencing greater cognitive overload and less confidence in their choices tend to opt for a partial lump sum.

Framing effects

Now we check for the robustness of the framing effects. Table A.2 shows five ordered probit regressions of the choice made in the first step (partial lump sum) on different sets of explanatory and control variables[12]. Note that, next to the frame dummies, we always control for the decision in step 2. Above, it is argued that the annuity choice will depend strongly on preferences regarding a high–low construction, which is therefore accounted for in all specifications.

Generally, the earlier reported evidence (see Figure 5) is confirmed by regression analysis. Only the impact of the IG frame turns out to be insignificant compared to that of the neutral frame. However, individuals indeed do assign lower values to "risky" annuities in an IG frame. All other frames have a significant negative effect on lump sum take-up. This confirms the earlier hypothesis of the frames having an overall activating effect, making respondents appreciate their annuities more.

We have argued that loss aversion and the reflection effect can predict the pairwise differences between gain and loss frames as well as consumption and investment frames. The regressions confirm these relative differences. The CL and IL frames more strongly nudge respondents toward annuities than their counterpart frames, CG and IG respectively. Hence, people are loss averse with respect to their annuitized wealth. Furthermore note individuals in the IL frame are more likely to choose an (risky) annuity (i.e., uncertain loss) than those in the CL frame (certain loss) are to choose an (safe) annuity. This result indeed suggests that

---

[11] A logit model is applied. Binary (dummy) variables are used regarding choosing a lump sum (yes/no), choosing a high–low scheme (yes/no), and choosing a low–high scheme (yes/no). For some combinations of the independent variable values, a linear model predicts probabilities below zero and above one, which does not make sense, for obvious reasons. A logit model eliminates this shortcoming by estimating a logistic function, which yields values between zero and one for all real numbers. Because of non-linearity, rather than applying ordinary least squares techniques, we estimate the function using the maximum likelihood method.

[12] An ordered probit model is used. The variable to be explained in most specifications is the choice in the first step of the experiment, which ranges from one to five (five means more lump sums than four). Technically, one could also assign quantitative meanings to these values (0%, 5%, 10%, 15%, and 20% of accruals) and estimate a linear model using ordinary least squares. However, in terms of model fit and normality of the error term, a maximum likelihood estimated ordered probit model has proven to do much better and is the preferred one. In a similar context, this model also has been applied by Cappelletti et al. (2013).

people gamble to avoid losses; they are risk seeking when faced with losses. At the same time, respondents are more likely to choose more (certain) annuitization in the CG frame than respondents are in the IG frame (where it is perceived as an uncertain gain). They are risk averse when comparing positive outcomes. Note that these results do not change across the different model specifications and are always highly significant.

Coming back to the interdependence of the two steps in the decision problem, the empirical evidence is partly surprising. On the one hand, choosing a high–low construction is associated with choosing a higher lump sum. This result would be in line with the earlier hypothesis, that a high–low construction is, in essence, a less extreme lump sum payment. Therefore, demand for both options should move together if the preferences (for early or late cash) are consistent across the two steps. On the other hand, there is also a highly significant positive relation between the choices of a low–high scheme and a lump sum, even though the low–high allocation is rather the opposite of a lump sum payment. However, in a follow-up experiment exploring the same choice option between full annuitization and a partial lump sum, individuals are explicitly asked how the lump sum will be spent. Individuals in the neutral frame indicate usage of the lump sums for specific spending destinations, particularly for the redemption of outstanding mortgages and other debts (52%), travel (32%), to maintain a liquid sum for unforeseen spending (7%), home maintenance, and more (Alilovic, 2016).

The next step controls for the effects of standard economic variables on the variation in annuitization behavior. Specification B (Econ) in Table A.2 adds a wide set of variables relevant to a lifetime utility-maximizing agent. Much in line with the literature expanding the life-cycle model, the applied proxy for bequest motives (children) is positively related to partial lump sum payments. Furthermore, people trade off their wealth and debt positions against their annuitization rates. Higher wealth is associated with a lower lump sum take-up. Those holding long-term debt (more than 10 years) annuitize less, presumably to pay off loans and save on interest payments. Higher risk tolerance is associated with greater lump sum take-up.

The specification also includes two variables on the verge of behavioral explanations: first, age, which has a highly significant negative relation with lump sum take-up (in all specifications). Hyperbolic discounting would imply that older individuals are more tempted by receiving the lump sum sooner than younger ones, who feel less pressure from postponing income to a more distant future. Apparently, this is not the case. Instead, older people appreciate annuities more than younger people do. One explanation could be an increasing reluctance to exchange one's accrued benefits (note that this is in terms of annuities in the Netherlands) for a lump sum. Similarly, the elderly could be more prone to inertia and not as keen to make an active choice in retirement planning as younger generations, who feel more connected to recent trends toward greater individual freedom of choice. Thus, it will be interesting to see how this age coefficient evolves over time for the Dutch case as older cohorts, which are more DB focused, exit the sample.

The second variable on the verge of behavioral economics is intertemporal discounting, approximated by patience for lottery payouts. The findings indicate intertemporal discounting is highly significant and positively related to lump sum pick-up.

The next specification in Table A.2 (C, Behavior) controls for characteristics capturing why and how people make mistakes in valuing annuities and hence make irrational (non–utility-maximizing) choices. Surprisingly, there is no significant effect on choice behavior stemming from variables related to involvement or financial sophistication (newsletter, contact_fund, involve, p_literacy, f_literacy). What is significant, though, is the positive relation between perceived financial literacy (lit_conf) and lump sum take-up. Similarly, there is a significant positive relation between self-indicated ability to arrange for one's pension (know_arrange) and lump sum take-up. From a social planner's perspective, this is an important insight. It is not actual sophistication that drives active decision making about lump sum take-up but, rather, self-perceived sophistication. Another highly significant variable is trust. Respondents showing greater trust in the fund as well as in the Dutch pension system tend to take up less lump sum. This finding highlights how much impact fund communications and behavior toward plan members can have on pension-related decisions via the perceived trustworthiness of the fund.

The combined specifications (columns D&E in Table A.2) mostly confirm the above findings. Interestingly, cognitive overload now becomes significant. It is rather worrying, though, that higher cognitive overload is associated with greater lump sum take-up, given that taking up lump sums and using the money wisely require greater financial sophistication than simply living off a monthly paid annuity. Note the relationship of higher lump sum and cognitive overload may be explained in both ways, the lump sum take-up being either as the clearer and easier option or as the more difficult one. This remains to be discussed in future research.

Overall, the frame dummies appear to be the most robust of all the variables. No combination of control variables causes the framing variables to become insignificant.

Conclusions

The above analysis provides strong evidence of the general validity of the framing hypothesis. All observed effects are in line with theoretical predictions. Most importantly, it is evident that annuitization behavior is subject to framing and that active framing can have a significant impact on overall annuitization rates. For the underlying sample, framing outstrips all other variables in terms of robustness and explanatory power. Many of the variables that capture difficulties in properly valuing annuities are associated with a higher demand for lump sum payments. This result highlights the behavioral nature of the underlying decision problem and the scope for welfare protection through professional intervention.

5.3 Heterogeneity

When considering framing as a tool of information architecture that can be applied to actively steer individual decision making, predictions must be made of how framing interacts with heterogeneity. Hence, the last step in assessing the framing hypothesis is to determine how the frames interact with other variables. This is done by adding interaction terms to the regression models.

A similar assessment of framing in the Dutch environment has been conducted by van der Heijden et al. (2012). They find that only impatience interacts significantly with framing. This

finding is not supported by the evidence from our experiment. The four variables that significantly interact with the frames are discussed in more detail: Gender, Age, Debt, and Risk tolerance. Table A.4 presents the results for specifications including the interaction terms and the most relevant control variables (economic as well as behavioral). Insignificant results are not reported. Table A.4 shows the results when no control variables are included.

5.3.1 Gender

Agnew et al. (2008) find men to be more affected by framing than women are. In particular, men are more likely to annuitize after they have seen an annuity-biased slideshow, while this had no effect on women. After an investment-biased slideshow, both genders annuitized less, with women showing a stronger reaction. In a way, this type of experiment is similar to our research. The results in column A of Table A.3 indeed may be seen as partly confirming the findings of Agnew et al. (2008). The coefficients for the framing variables (CG, CL, IG, IL) now represent the effects of the frames on female respondents. The effect on men is the sum of these coefficients plus the corresponding interaction term. First, it is striking that only the IG coefficient is significant (positive) now, while it is not significant in the analysis when the interaction between gender and framing is not accounted for (see Table A.2). This result means that only the IG frame has a significant impact on female choice behavior. Once women are put in an IG frame, they show a much stronger preference for lump sums, which would be in line with the work of Agnew et al. (2008). Additional annuitization in the investment frame is perceived as risky (uncertain gain). Apparently, women now show very strong aversion to more risk and would rather take a lump sum in that case in line with the expected outcome for the IG frame as described in section 2, in particular figure 1. The difference from their male counterparts becomes even clearer when adding up the IG coefficient (0.37) and the IG–male interaction coefficient (-0.4), which leads to a negative net effect for men. Apparently, male plan members show even more demand for annuities once these are framed as a risky financial product. For men the riskiness of additional annuitization within the investment frame is perceived as an uncertain loss rather than an uncertain gain, activating risk-seeking behavior and so more annuities.

Additionally, men are not affected by the CL frame, while the overall population is (-0.32). Hence, it is mainly women who take up more annuities in the CL frame once they are explained that lump sum payments imply certain loss. The pattern here appears to be that women assign much higher values to the safety provided by annuities, while men are quite willing to take on risk in their retirement income. With respect to the CG and IL frames, the evidence reported on interaction coefficients and the insignificance of the female coefficients imply stronger framing effects (toward annuities) for men than for the overall population.

Hence, the finding of Agnew et al. (2008) of men being more sensitive to framing is confirmed for the CG and IL frames but rejected for the IG and CL frames, which in turn appear to have a stronger impact on women. The evidence provided does not support the hypothesis of gender playing a role in framing per se. It is not the case that men are more responsive than women or vice versa. What can be seen instead is that men and women are responsive to different frames.

5.3.2 Age

After interacting the frames with a dummy indicating above-median age (57.8 years), older plan members appear to be more responsive to framing. All interaction dummies show

negative signs, indicating that the overall push toward annuities is stronger among older respondents. Again, there is even an inversion effect on the IG frame. While the coefficient for the younger respondents is 0.23, it is up to -0.12 (0.23–0.35) for respondents older than 57.8 years. Once the younger are framed with investment language and uncertain gains in return when they would increase their annuity, they decide on the (safe) lump sum. The elderly, however, feel encouraged to annuitize in the very same frame.

5.3.3 Debt

From an economic point of view, it is utility optimizing to pay off loans by cashing out pension assets to save on interest payments (presupposing that the interest on loans is higher than the return on pension assets). Hence, loss of welfare will arise if framing discourages debt holders from doing so. The positive interaction coefficients in column C of Table A.4 however, show such strong values that they partly offset the coefficients for the frames. It seems that, if there is a solid economic rationale behind the decision to cash out pension assets, it is more difficult to distort that decision. Framing is less effective when it interferes with stable preferences derived from individual economic considerations.

5.3.4 Risk tolerance

Risk preferences and how they are subject to perceived certainty are at the heart of the framing hypothesis. Therefore, it is of great interest to see how risk tolerance interacts with the frames. Column D of Table A.4 shows how more risk-tolerant individuals are influenced less by the frames. The negative coefficients for the frame dummies are partly offset by the positive values of the interaction coefficients. Overall, risk-tolerant people are harder to steer toward more annuitization. This effect, however, remains only significant for the CL frame when control variables are included (see column D in Table A.3).

Final

The analysis of interaction effects has added one important insight to the framing hypothesis: Its validity depends significantly on the characteristics of the underlying population. With respect to the effectiveness of active framing, some characteristics have a catalyzing effect (male, age) and others a debilitating effect (risk tolerance, debt holdings). This result has important implications for pension professionals. Given that individuals are steered actively into predictable directions, understanding the population's heterogeneity is imperative.

6 Discussion

The implications of this research project are twofold. First, they are relevant to the academic world and the literature on the annuitization puzzle as well as on the framing hypothesis. Second, they affect pension professionals and policy makers involved in the design and communication regarding the decumulation of pension assets.

6.1 'Reversed' annuity puzzle

The predictions of the life-cycle model often do not match observed annuitization rates in real markets. Many authors have tried to solve the so-called annuity puzzle by either expanding the life-cycle model or researching the human limitations to properly valuing annuities. These studies all acknowledge the annuity puzzle as a general phenomenon. Our

experiment among Dutch pension fund participants finds limited preference for utilizing the new optionality of partial lump sum take-up at retirement, even though the minimum annuitization rate was kept at a high level of 80%. The evidence supports earlier findings of the phenomenon being more circumstantial than generally valid. However, the question then remains why that is. Do the Dutch not make the same mistakes in valuing annuities as, for instance members, of 401(k) plans in the United States? Or do they simply make different mistakes and is the decision to annuitize indeed always subject to human biases? Brown et al. (2008) suggest that an important problem in the United States is that annuities tend to be evaluated through an investment frame rather than a consumption frame. Benartzi et al. (2011) argue that pension accrual in lump sums fosters investment framing, while accrual in annuities promotes consumption framing. With the latter being the case in the Netherlands, it is very possible that the high annuitization rates observed in our experiment result from Dutch plan members filtering the decision through a consumption frame. Hence, they would be making similar mistakes as US plan members but, from an economist's point of view, in their own best interests, leading to a somewhat reversed annuitization puzzle. Therefore, when explaining annuity demand, one needs to keep in mind not only the underlying human biases but also the institutional environment. The idea is that different institutional settings can trigger different biases in decision making.

To test this line of argumentation, we assess the reaction to framing in the unique Dutch environment. If the frames work the same way as in the United States, the results would significantly support the general applicability of the framing hypothesis and its explanatory power with respect to annuity demand. We find the frames do apply to the Dutch case. Respondents reacted as behavioral economics (mental accounting and prospect theory) predicts. The stronger impact of the investment frames compared to that of the consumption frames suggests that respondents were initially not thinking of their pension income as an investment product but, rather, in terms of a consumption path. The significance of these results is further supported by the fact that this research uses a personalized experiment based on actual expected individual pension accruals at retirement, minimizing alienation bias. Rigorous testing for other explanations possibly outstripping the framing effects support the results.

Our conclusion is therefore that annuity demand generally depends significantly on framing effects. The effect framing has, however, depends on the institutional environment, which predefines the perspective through which individuals filter annuities. To settle this issue, future research, based on studies across countries with varied pension plan diversity, is needed.

6.2 Professional intervention

Concerning the introduction of a partial lump sum pension option in the Netherlands, important practical questions arise for policy makers and pension professionals. Who will use the lump sum option and to what extent? How steerable is the demand for the lump sum option? Should one intervene in the decision making processes of individuals and, if so, how should one intervene when recognizing the variety and heterogeneity in individuals' backgrounds and preferences? We find that the majority of plan members would use a partial lump sum payment if it were implemented as in the experiment. However, given insights from academia, it is likely that many plan members will fall victim to biased decision making,

leading to overall welfare loss. At the same time, this loss is contrasted by the welfare gains of those able to reach higher utility levels due to greater individualization. From a social planner's perspective, there is a delicate trade-off between freedom of choice and loss of welfare. An optimal solution minimizes the potential welfare loss from biased decision making, providing a certain level in freedom of choice (or a maximum degree of freedom for a given level of welfare).

To understand the possible origins of welfare loss, it is important to know which biases apply to the decision to annuitize and how they can be avoided. This is where framing and default settings open up a whole box of tools to pension professionals. Our research confirms, first, how the decision to annuitize is subject to mental accounting and framing. Second, it shows how individuals are sensitive to framing and defaults and can thereby be actively steered in predictable directions. Additionally, the analysis not only predicts overall behavior but also shows how one could deal with heterogeneity. The study shows how frames can have opposite effects for different age cohorts or genders, for instance. The greater the knowledge of these different sensitivities in combination with a good understanding of the underlying heterogeneities, the more framing can be helpful in steering individual choice to minimize overall welfare loss.

Two major concerns remain regarding active framing and defaults. First, the fact that individuals are steered in predictable directions does not imply they are being steered in a direction that improves utility. This paper shows that annuity choice is subject to human biases in decision making and that choice can be influenced by actively playing on these biases. Future research will have to define what is optimal for a heterogeneous population, that is, the directions in which different people are to be steered. Second, any kind of framing or nudging implies that people are pushed into making a choice they would initially not have made. One could argue that the Dutch pension system, with its paternalistic way of arranging for retirement income, interferes even more severely with freedom of choice. The point here, however, is that framing and defaults setting interfere with freedom of choice without making it transparent to individuals. Even then, advocates of libertarian paternalism argue that framing is still superior to a purely paternalistic approach because it does not take away choice from those who show stable preferences, whereas it minimizes welfare loss from those hampered by biased decision making. The reach of steering by framing and default settings ultimately depends on where the Dutch pension community finds the best balance between paternalism and liberalism.

7 Conclusion

This paper presents the first results of testing the framing hypothesis in the institutional environment of the Netherlands, where people are used to full annuitization. The experiment is organized around the very likely introduction of the choice option at retirement to allocate their accrued pension between a life annuity and a partial lump sum. The experimental setting is realistic as the choice menu is based on the respondents' real projected pension accrual and on their own pension plans. Dutch plan members generally welcome the partial lump sum option over full annuitization.

We find strong evidence of joint effects of combining investment and consumption frames with gain and loss frames. These sensitivities potentially may be used for professional

intervention for steering individual decision-making in pension choices into an expert-based direction. However the experiment also clarifies that a general application of frames as such may not be effective in case of heterogeneity among plan participants. In particular we found that framing may differ as to gender, age, risk attitude and debt position. Before implementing active framing, further research is needed to improve the tuning of interventions to individuals' variety in proneness for framing.

The average lump sum take-up is quite modest when one recognizes the Netherlands is an over-annuitized country. It is plausible that the specific institutional environment of a country play a key role in how individuals appreciate annuities. Future research, based on studies across countries with varied pension plan diversity, is needed to capture the country-specific component in annuity demand.

Our overall conclusion is therefore that annuity demand generally depends significantly on framing effects. The effect framing has, however, depends on the institutional environment, which predefines the perspective through which individuals filter annuities.

References

Agnew, J.R., Anderson, L.R., Gerlach, J.R., Szykman, L.R., 2008. Who chooses annuities? An experimental investigation of the role of gender, framing, and defaults. *American Economic Review,* 98, 418–422.

Agnew, J.R., Szykman, L., 2010. *Annuities, financial literacy and information overload*. Pension Research Council WP, 33.

Alilovic L., 2016. Effect of Peer Information on Pension Payout Decisions, Tilburg University, working paper.

Bart F., Boon B., Bovenberg L., van Ewijk C. Kortleve N., Rebers E., and Visser M., *De routekaart naar een meer integrale benadering van wonen, zorg en pensioen*, Netspar Occasional Paper 01/2016, 2016.

Benartzi, S., Previtero, A., Thaler, R.H., 2011. Annuitization puzzles. *Journal of Economic Perspectives*, 25, 143–164.

Beshears, J., Choi, J.J., Laibson, D., Madrian, B.C., Zeldes, S. P., 2014. What makes annuitization more appealing? *Journal of Public Economics*, 116, 2–16.

Brown J., 2007. *Rational and behavioral perspectives on the role of annuities in retirement planning*. NBER working paper 13537.

Brown, J.R., Kapteyn, A., Luttmer, E.F., Mitchell, O.S., 2014. *Cognitive constraints on valuing annuities*. National Bureau of Economic Research.

Brown, J.R., Kapteyn, A., Mitchell, O.S., 2013. Framing and claiming: How information-framing affects expected social security claiming behavior. *Journal of Risk and Insurance*.

Brown, J.R., Kling, J. R., Mullainathan, S., Wrobel, M. V., 2008b. *Why don't people insure late life consumption a framing explanation of the under-annuitization puzzle*. NBER working paper series working paper 13748.

Brown, J.R. and Nijman Th., Options to Improve the Decumulation of Pension Wealth in the Netherlands, in: Bovenberg L., van Ewijk C. and Westerhout E. (eds.), *The Future of Multi-Pillar Pensions*. Cambridge University Press.

Bütler, M., Teppa, F., 2007. The choice between an annuity and a lump sum: Results from Swiss pension funds. *Journal of Public Economics*, 91(10), 1944–1966.

Cannon, E., Tonks, I., 2011. *Welfare, money's worth and policy implications*. Netspar panel paper 24.

Cappelletti, G., Guazzarotti, G., Tommasino, P., 2013. What determines annuity demand at retirement. *Geneva Papers on Risk and Insurance-Issues and Practice*, 38(4), 777–802.

Davidoff, T., Brown, J.R., Diamond, P.A., 2003. *Annuities and individual welfare*. National Bureau of Economic Research.

Fagley N.S., 1993. A note concerning reflection effects versus framing effects. *Psychological Bulletin* 113(3), 451–452.

Garciá-Huitrón, M. and Ponds, E.H.M., 2015, *Worldwide Diversity in Funded Pension Plans: Four Role Models on Choice and Participation*, http://ssrn.com/abstract=2606616

Gentry, W.M., Rothschild, C.G., 2006. Lifetime annuities for US: Evaluating the efficacy of policy interventions in life annuity markets. American Council for Capital Formation, available at www. accf. org.

Hanemann, W.M., 1994. Valuing the environment through contingent valuation. *Journal of Economic Perspectives*, 19-43.

Hu, W.-Y., Scott, J.S., 2007. Behavioral obstacles in the annuity market. *Financial Analysts Journal*, 63(6), 71–82.

Hurd, M., Panis, C., 2006. The choice to cash out pension rights at job change or retirement. Journal of Public Economics, 90(12), 2213–2227.

Kahneman, D., Tversky, A., 1979. Prospect theory: An analysis of decision under risk. *Econometrica*, 263-291.

Kahneman, D., Tversky, A., 1984. Choices, values, and frames. *American Psychologist*, 39(4), 341.

Kemna, A.A., Ponds, E.H.M, Steenbeek, O.W., 2011. Pension funds in the Netherlands. *Journal of Investment Consulting*, 12(1), 28–34.

Loibl, C., Bruine de Bruin, W., McNair, S., Summers, B., 2015. Pension Freedom Day in the UK: Examining pension decisions, paper in progress.

Lusardi, A., Mitchel, O., 2007. Financial literacy and retirement preparedness: Evidence and implications for financial education. *Business Economics*, 42(1), 35–44.

Mottola, G.R., Utkus, S.P., 2007. Lump sum or annuity? An analysis of choice in DB pension payouts. *Vanguard Center for Retirement Research*, 30(89), 2.

Pensioen Federatie, 2015. The Dutch Pension System.

Ponds, E.H.M., van Riel, B., 2009. Sharing risk: The Netherlands' new approach to pensions. *Journal of Pension Economics and Finance*, 8(1), 91–105.

Santos, J.R.A., 1999. Cronbach's alpha: A tool for assessing the reliability of scales. *Journal of Extension*, 37(2), 1–5.

Thaler, R., 1985. Mental accounting and consumer choice. *Marketing Science*, 4(3), 199–214.

Thaler, R.H., Benartzi, S., 2004. Save more tomorrow: Using behavioral economics to increase employee saving. *Journal of Political Economy*, 112(S1), S164–S187.

Tversky, A., Kahneman, D., 1981. The framing of decisions and the psychology of choice. *Science*, 211(4481), 453–458.

Tversky, A., Kahneman, D., 1991. Loss aversion in riskless choice: A reference-dependent model. *Quarterly Journal of Economic*s, 1039–1061.

Van der Heijden, E., Klein, T. J., Müller, W., Potters, J., 2012. Framing effects and impatience: Evidence from a large scale experiment. *Journal of Economic Behavior & Organization*, 84(2), 701–711.

Whittington, D., 2002. Improving the performance of contingent valuation studies in developing countries. E*nvironmental and Resource Economics*, 22(1–2), 323–367.

Yaari, M.E., 1965. Uncertain lifetime, life insurance, and the theory of the consumer. *Review of Economic Studies*, 137–150.

Appendix A Tables

Table A.1 Logit Regression Partial Lump Sum Choice

Specification:	A	B	Cut?	D	E
VARIABLES	Frames only	Economic	Behavioral	Combined	Best
dflat	-0.46***	-0.52***	-0.52***	-0.54***	-0.44***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
dhigh	0.11	0.01	-0.01	-0.05	0.09
	(0.47)	(0.95)	(0.97)	(0.81)	(0.61)
low_high	1.38***	1.54***	1.39***	1.52***	1.34***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
high_low	1.85***	1.95***	1.94***	1.95***	1.89***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
male		0.01	0.24*	0.10	0.03
		(0.97)	(0.09)	(0.56)	(0.86)
age		-0.04***	-0.03***	-0.04***	-0.04***
		(0.00)	(0.00)	(0.00)	(0.00)
life_expectancy		0.00		0.00	
		(0.60)		(0.70)	
married		0.21		0.24	0.39*
		(0.37)		(0.32)	(0.06)
was_married		0.31		0.39	0.59**
		(0.28)		(0.19)	(0.02)
income_part_time		-0.00		-0.00	
		(0.46)		(0.59)	
annuity		0.00**		0.00**	0.00***
		(0.03)		(0.03)	(0.00)
children		0.13*		0.14*	0.11*
		(0.06)		(0.05)	(0.10)
zhealth		-0.18**		-0.16**	-0.07
		(0.02)		(0.03)	(0.28)
zwealth		-0.12		-0.16**	-0.10
		(0.13)		(0.04)	(0.16)
long_debt		0.44***		0.49***	0.35**
		(0.01)		(0.00)	(0.01)
zrisk_general		0.16**		0.17**	0.18**
		(0.04)		(0.04)	(0.02)
stocks		-0.49***		-0.46**	-0.47***
		(0.01)		(0.01)	(0.00)
zdiscount		0.46***		0.43***	0.41***
		(0.00)		(0.00)	(0.00)
red_numbers				0.28*	0.07	
				(0.07)	(0.73)	
contact_fund				-0.02**	-0.01	-0.01*
				(0.02)	(0.16)	(0.06)
zinvolve				0.10	0.06	
				(0.13)	(0.41)	
zf_literacy				0.12	0.13	
				(0.12)	(0.17)	
zp_literacy				0.03	0.01	
				(0.69)	(0.86)	
zlit_conf				-0.05	-0.00	
				(0.51)	(0.96)	
zdecision_conf				-0.14*	-0.11	-0.16**
				(0.07)	(0.19)	(0.04)
zoverload_cogn				0.22***	0.28***	0.23***
				(0.01)	(0.00)	(0.00)
ztrust2				-0.03	-0.09	-0.08
				(0.64)	(0.25)	(0.20)
zknow_arrange				0.15**	0.15*	0.17**
				(0.02)	(0.05)	(0.02)
Constant	-0.90***	0.11		0.63	0.05	0.43
	(0.00)	(0.91)		(0.20)	(0.96)	(0.41)
Observations	1381	1004		1235	1990	1229
Prob > Chi2	0	0		0	0	0
Pseudo-R2	0.0473	0.126		0.0808	0.147	0.134

Robust p-values in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1
Dependent variable: step one choice (lump_sum_dummy ; 1 = yes, 0 = no); logit

Table A.2 Ordered Probit Regression: Step 1

Specification:	A	B	C	D	E
VARIABLES	Frames	Econ	Behavioral	Combined	Best
CG	-0.21***	-0.21**	-0.24***	-0.22**	-0.22**
	(0.01)	(0.02)	(0.00)	(0.01)	(0.01)
CL	-0.35***	-0.34***	-0.35***	-0.32***	-0.32***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
IG	0.05	0.07	0.02	0.08	0.07
	(0.49)	(0.44)	(0.83)	(0.39)	(0.42)
IL	-0.39***	-0.38***	-0.44***	-0.36***	-0.37***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
low_high	0.58***	0.55***	0.59***	0.52***	0.52***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
high_low	1.00***	1.03***	1.06***	0.98***	0.97***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
male		-0.05	0.03	-0.07	-0.07
		(0.49)	(0.60)	(0.32)	(0.33)
age		-0.02***	-0.01***	-0.02***	-0.02***
		(0.00)	(0.00)	(0.00)	(0.00)
life_expectancy		-0.01		-0.01*	-0.01*
		(0.21)		(0.05)	(0.06)
married		0.09		0.12	0.11
		(0.34)		(0.19)	(0.24)
was_married		0.20*		0.23**	0.23**
		(0.08)		(0.04)	(0.05)
income_part_time		0.00		0.00	0.00***
		(0.92)		(0.87)	(0.00)
replacement		-0.22		-0.31	
		(0.66)		(0.54)	
annuity		0.00		0.00	
		(0.44)		(0.45)	
children		0.05*		0.05*	0.05*
		(0.08)		(0.08)	(0.07)
zhealth		0.01		0.02	
		(0.78)		(0.45)	
zwealth		-0.07**		-0.07**	-0.07**
		(0.03)		(0.04)	(0.03)
other_annuities		0.04			
		(0.56)			
long_debt		0.15**		0.15**	0.16**
		(0.03)		(0.03)	(0.02)
short_debt		0.09			
		(0.29)			
zrisk_general		0.10***		0.08***	0.08***
		(0.00)		(0.01)	(0.01)
stocks		0.05			
		(0.51)			
zdiscount		0.11***		0.11***	0.11***
		(0.00)		(0.00)	(0.00)
red_numbers			0.23***	0.11	0.10
			(0.00)	(0.13)	(0.15)
newsletter			-0.03		
			(0.82)		
contact_fund			-0.00		
			(0.60)		
zinvolve			0.00		
			(0.99)		
zp_literacy			0.02	0.03	
			(0.45)	(0.30)	
zf_literacy			0.04		
			(0.26)		
zlit_conf			0.08**	0.06*	0.07**
			(0.02)	(0.09)	(0.04)
zdecision_conf			0.00		
			(0.97)		
zoverload_cogn			0.04	0.06*	0.06*
			(0.28)	(0.07)	(0.05)
ztrust2			-0.10***	-0.09***	-0.10***
			(0.00)	(0.01)	(0.00)
zknow_pension			-0.04	-0.06*	
			(0.26)	(0.07)	
zknow_arrange			0.09***	0.08**	0.07**
			(0.00)	(0.02)	(0.04)
Cut 1	0.46***	-0.57	-0.16	-0.79*	-0.66
	(0.00)	(0.23)	(0.49)	(0.10)	(0.10)
Cut 2	0.85***	-0.14	0.24	-0.36	-0.24
	(0.00)	(0.77)	(0.31)	(0.44)	(0.56)
Cut 3	1.35***	0.39	0.77***	0.17	0.30
	(0.00)	(0.41)	(0.00)	(0.72)	(0.47)
Cut 4	1.56***	0.59	0.96***	0.38	0.50
	(0.00)	(0.21)	(0.00)	(0.42)	(0.21)
Observations	2234	1591	1991	1651	1652
Prob > Chi2	0	0	0	0	0
Pseudo-R2	0.0269	0.0522	0.0451	0.0570	0.0558

Robust p-values in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1

Dependent variable: step1 choice (1 to 5); ordered_numbers probit

Table A.3 Ordered Probit: Step 1 with Interaction and Control

Specification:	A	B	C	D
Interaction of frame with:	Male	Age	Long_Debt	Risk_Gen.
VARIABLES				
CG	0.05	-0.11	-0.59***	-0.22**
	(0.80)	(0.32)	(0.00)	(0.01)
CL	-0.24	-0.21*	-0.58***	-0.34***
	(0.17)	(0.05)	(0.00)	(0.00)
IG	0.37**	0.23**	-0.12	0.06
	(0.04)	(0.03)	(0.53)	(0.52)
IL	-0.04	-0.19	-0.68***	-0.37***
	(0.82)	(0.10)	(0.00)	(0.00)
low_high	0.51***	0.51***	0.50***	0.51***
	(0.00)	(0.00)	(0.00)	(0.00)
high_low	0.97***	0.97***	0.95***	0.96***
	(0.00)	(0.00)	(0.00)	(0.00)
CG × Interaction	**-0.36***	**-0.24***	**0.54*****	**-0.02**
	(0.09)	**(0.08)**	**(0.01)**	**(0.83)**
CL × Interaction	**-0.10**	**-0.22**	**0.37***	**0.17****
	(0.63)	**(0.12)**	**(0.06)**	**(0.05)**
IG × Interaction	**-0.40****	**-0.35****	**0.29**	**0.14**
	(0.05)	**(0.01)**	**(0.17)**	**(0.14)**
IL x Interaction	**-0.44****	**-0.36****	**0.44****	**0.06**
	(0.03)	**(0.01)**	**(0.03)**	**(0.52)**
male	0.19	-0.06	-0.06	-0.06
	(0.17)	(0.41)	(0.37)	(0.37)
age	-0.02***	-0.01*	-0.02***	-0.02***
	(0.00)	(0.06)	(0.00)	(0.00)
life_expectancy	-0.01*	-0.01	-0.01*	-0.01*
	(0.06)	(0.10)	(0.07)	(0.06)
married	0.11	0.09	0.09	0.11
	(0.25)	(0.31)	(0.34)	(0.25)
was_married	0.23**	0.20*	0.22*	0.22*
	(0.05)	(0.08)	(0.05)	(0.05)
income_part_time	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
children	0.05*	0.05*	0.06**	0.05*
	(0.08)	(0.07)	(0.04)	(0.07)
zwealth	-0.07**	-0.07**	-0.07**	-0.07**
	(0.03)	(0.03)	(0.02)	(0.03)
long_debt	0.16**	0.14**	-0.17	0.15**
	(0.02)	(0.03)	(0.21)	(0.02)
zrisk_general	0.08**	0.08**	0.09***	0.01
	(0.01)	(0.02)	(0.00)	(0.86)
zdiscount	0.11***	0.11***	0.11***	0.11***
	(0.00)	(0.00)	(0.00)	(0.00)
red_numbers	0.10	0.10		0.11
	(0.16)	(0.18)		(0.14)
zlit_conf	0.07*	0.07**	0.07**	0.07**
	(0.05)	(0.03)	(0.04)	(0.04)
zoverload_cogn	0.06*	0.07**	0.06*	0.07**
	(0.05)	(0.04)	(0.05)	(0.05)
ztrust2	-0.10***	-0.09***	-0.10***	-0.10***
	(0.00)	(0.00)	(0.00)	(0.00)
zknow_arrange	0.07**	0.07**	0.06*	0.06**
	(0.03)	(0.02)	(0.06)	(0.04)
Constant	-0.46	-0.09	-0.88**	-0.66
	(0.26)	(0.83)	(0.03)	(0.10)
Observations	1652	1652	1652	1652
Prob > Chi2	0	0	0	0
Pseudo-R2	0.0575	0.0587	0.0557	0.0573

Robust p-values in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1

Dependent variable: step1 choice (1 to 5); ordered_numbers probit

Table A.4 Ordered Probit: Step1, Interaction Only

Specification:	A	B	C	D
Interaction of frame with:	Male	Age	Long Debt	Risk General
VARIABLES				
CG	-0.32**	-0.08	-0.50***	-0.21***
	(0.01)	(0.36)	(0.00)	(0.01)
CL	-0.48***	-0.19**	-0.60***	-0.37***
	(0.00)	(0.04)	(0.00)	(0.00)
IG	0.09	0.20**	-0.09	0.02
	(0.44)	(0.02)	(0.53)	(0.75)
IL	-0.28**	-0.17*	-0.58***	-0.39***
	(0.02)	(0.06)	(0.00)	(0.00)
low_high	0.58***	0.58***	0.55***	0.57***
	(0.00)	(0.00)	(0.00)	(0.00)
high_low	1.00***	1.00***	1.04***	0.98***
	(0.00)	(0.00)	(0.00)	(0.00)
CG × Interaction	**0.15**	**-0.25****	**0.43*****	**0.09**
	(0.25)	**(0.02)**	**(0.00)**	**(0.13)**
CL × Interaction	**0.18**	**-0.34*****	**0.39*****	**0.17*****
	(0.15)	**(0.00)**	**(0.00)**	**(0.00)**
IG × Interaction	**-0.06**	**-0.34*****	**0.17**	**0.22*****
	(0.65)	**(0.00)**	**(0.22)**	**(0.00)**
IL × Interaction	**-0.15**	**-0.43*****	**0.24***	**0.12****
	(0.22)	**(0.00)**	**(0.08)**	**(0.04)**
Constant	0.46***	0.45***	0.43***	0.44***
	(0.00)	(0.00)	(0.00)	(0.00)
Observations	2234	2234	2000	2234
Prob > Chi2	0	0	0	0
Pseudo-R2	0.0278	0.0335	0.0340	0.0323

Robust p-values in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1

Dependent variable: step1 choice (1 to 5); ordered_numbers probit

Appendix B Definitions of variables in survey

Variable	Explanation	Values	Expected effect on step1 (i.e lump sum takeup	Hypothesis
Dependent Variables				
Step1	Captures how much lump sum is taken in first step of experiment	1,2,3,4,5 for a lump sum take up of (as relative size accrual): 0; 0.05; 0.1; 0.15; 0.2		
High-low	Indicates if any of the 5 high-low allocations was chosen	1=yes, 0=no		
Low-high	Indicates if any of the 5 low-high allocations was chosen	1=yes, 0=no		
Framing Variables (explanatory / independent)				
CG	consumption gain	1=yes, 0=no	-	See **Error! Reference source not found.**& section 2
CL	consumption loss	1=yes, 0=no	-	See **Error! Reference source not found.**& section 2
IG	investment gain	1=yes, 0=no	+	See **Error! Reference source not found.**& section 2
IL	Investment loss	1=yes, 0=no	-	See **Error! Reference source not found.**& section 2
dflat	Default = 0 ls & no high_low	1=yes, 0=no	-	See section 2
dhigh	Default=0.1 lump sum & high-low	1=yes, 0=no	+	See section 2
n	neutral frame	1=yes, 0=no	/	See section 2
Rational / Standard Economic Theory Variables (explanatory / independent / control)				
age	Respondents age	in years	**-**	Elderly are more risk averse, seek longevity insurance
male	Indicates gender	1=male, 0=fem	**+**	Men are more risk seeking and confident in financial skills
Married / was married	Two separate dummies to cover married, unmarried, widowed	For both: 1=yes, 0=no	Married **+**	Married engage in intrafamily longevity risk pooling
Income_full_ time	Full time equivalent Income	in €	**-**	High income earners need less additional liquidity
Part_time_ factor	Working hours in % of full time	0.1-1.2	**-**	See income
Income_ part_time	Current work income	=part time factor*full	**-**	See income

		time income		
upo	Projected annual pension right	in €	**-**	See income
other_annuities	Is any annuitized wealth expected outside the plan	1=yes; 0=no	**+**	Already annuitized wealth increases demand for liquidity
wealth	Total wealth, any assets	1=0-2000€ 2=2001-10000€ 3=10001-20000 4=20001-50000 5=50001-100k 6=100001-150k 7= above 150k	**-**	Need for liquidity decreases with wealth
houseowner		1=yes; 0=no	**+**	Illiquidity of housing→ more lump sum
house_paid	Expects to have house paid off until retirement	1=yes; 0=no	**-**	When house paid off, no need to pay debt with lump sum cash out
short_debt	Has (consumption) credits with duration<10Y	1=yes; 0=no		
long_debt	Has loans with duration>10Y	1=yes; 0=no	**+**	Lump sum used to pay off loans
stocks	Holds stocks	1=yes; 0=no	**+/-**	More risk seeking → less annuitization / Higher finance. sophistication→ value annuities correctly
risk_general	Self indicated general risk appetite	1=always avoid risks, 2=avoid risks, 3=neutral, 4=take risks, 5=always take risks	**-**	More Risk averse → value longevity insurance
risk_aversion_ life	Life time income gamble	1=not risk – 4=very risk av.	**-**	See above
discount	willingness to delay lottery payout (patience)	1=very low – 5=very high	**+**	Impatient respondents or heavy discounters prefer lump sums
children	Number of children	1=1; 2=2 3=3 4= more than 3	**+**	Children as proxy for bequest motive → more lump sum
health	Self indicated general condition	1=poor 2,3,4, 5= very good	**-**	Good health increases demand for longevity insurance
life_expectancy	Self indicated life expectancy	In years (age)	**-**	Higher life expectancy → more longevity insurance
Behavioral Variables (independent / explanatory / control)				
red_numbers	Uses more than 5 times/year credit on cash account	1=yes; 0=no	**+**	Very costly form of credit as irrational as underannuitization
education	Highest level	1=basic 2=continued 3=lower 4=middle 5=higher 6=academic 7=PhD	**-**	Higher educated will find it easier to value the annuity and have less need for liquidity due to higher wealth

involvement	Combines several questions, measure pension-interest	0-1	**-**	More involved have less difficulties in valuing annuities
newsletter	Receives fund-neswletter (e-mail)	1=yes; 0=no	**-**	Different proxy for involvement
contact_fund	Number of contact with fund in last	# of contacts	**-**	Different proxy for involvement
trust	Combines several questions, systemic & fund trust	0-1	**-**	More trust → rely on fund and less fear of default
f_literacy	Financial literacy (Lusardi, Mitchel)	1,2,3,4,5	**-**	More literate value annuities correctly
p_literacy	Pension literacy (system specific)	1,2,3,4,5	**-**	See f-literacy
Lit_confidence	# of f_lit. questions confident to have answered correctly	0,1,2,3,4,5	**+**	Overconfidence may lead to "underannuitization)
decision_conf	Confidence to have taken "right" decision	1,2,3,4,5	**-**	Confidence is associated with understanding annuities → less LS
overload_cogn	Combines several questions about experiment	0-1	**+**	Overload → LS appears as less complicated (more attractive)
know_pension	Knows height of current projected pension right	1,2,3,4,5	**-**	Well informed appreciated longevity insurance
know_arrange	Knows enough to arrange well for own pension	1,2,3,4,5	**-**	See above

Appendix C Questionnaire

The questionnaire is available on request (eduard.ponds@apg.nl).